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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/025,085	12/19/2001	Cher Huan Tan	2085-00600 (IME-P002US)	4906

23505 7590 06/30/2003

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EXAMINER

PHAM, THANHHA S

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 06/30/2003

8

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/025,085

Applicant(s)

TAN ET AL.

Examiner

Thanhha Pham

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 4-20 is/are pending in the application.
- 4a) Of the above claim(s) 6-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4 and 5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 08 April 2003 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

This Office Action responses to Applicant's Amendment in Paper No. 7 dated 4/8/03.

Election/Restrictions

1. This application contains claims 6-20 drawn to an invention nonelected with traverse in Paper No. 3 and interview dated 10/29/02. A complete reply to the final rejection must include cancelation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. **Claims 1-2 and 4-5 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.** The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Limitation of "depositing anti-reflective material onto the insulation layer for forming a sacrificial layer thereon, the anti-reflective material being chemically inert to the low-k dielectric material and being contact with the fill-in material,

wherein the fill-in material and the antireflective material have different material properties" renders the claim indefinite because a usage of the sacrificial layer of the antireflective material being chemically inert to the low-k dielectric material and having different material property to the fill-in material is not supported by specification.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

3. Claims 1-2 and 4, as being best understood, are rejected under 35 U.S.C. 102(e) as being anticipated by Lin et al [US 6,323,123].

➤ With respect to claim 1, Lin et al, figs 2's and col 1-5, discloses the claimed method for lithographic patterning a via-first dual damascene process involving the use of a low-k dielectric material as an insulation layer on a wafer substrate during the fabrication of an integrated circuit, the method comprising the steps of:

covering the walls of an aperture (270, fig 2D-2E, col 4 lines 3-48) etched into an insulation layer (230/235/240) on a wafer substrate (200) with a fill-in material (280) for isolating a portion of the insulation layer in the aperture from a photoresist layer (300, fig 2F) deposited thereafter, the fill-in material being chemically inert to the low-K dielectric material (col 5 lines 22-30: Lin et al discloses using the gap-filling material to avoid destroying the low-k dielectric material when performing dual-damascene process; it is implied that the gap-filling material is chemical inert to the low-k dielectric material to avoid destroying the low-k dielectric material) ;

depositing anti-reflective material (290, fig 2F, col 4 lines 49-58) onto the insulation layer (230/235/240) for forming a sacrificial layer thereon, the anti-reflective material (290) being in contact with the fill-in material (280);

depositing a photoresist layer (300, fig 2F, col 4 lines 49-58) on the sacrificial layer (290);

exposing and developing the photoresist layer for providing a photoresist mask pattern for subsequent etching of the insulation layer (figs 2F, col 4 lines 53-68: Lin et al discloses the photoresist 300 is defined to form a shallow pattern area and to expose the partial surface of the via hole – it is implied that the photoresist is exposed and developed to provide the photoresist mask pattern 300 as in fig 2F); and

removing the fill-in material from the aperture (fig 2G, col 4 lines 59-67).

- With respect to claim 2, Lin et al discloses the step of covering the walls of [the aperture comprises the step of full filling the aperture (fig 2E-2F).
- With respect to claim 4, Lin et al (col 4 lines 39-48) discloses the step of full filling the aperture comprises the step of full filling the aperture with a solvent based fill-in material (spin-on-glass method).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 3, as being best understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al [US 6,323,123] as applied to claim 2 above, in further view of Hussein et al [US 6,329,118].

Lin et al substantially discloses the claimed method including full-filling the aperture with the fill-in material. Lin et al does not expressly teach said step of full-filling the aperture with antireflective coating.

Hussein et al (figs 1c-1f, col 6 lines 12-52) discloses full-filling the aperture (107) with the antireflective coating (104) to improve photolithographic process in forming the dual-damascene structure.

Therefore, it would have been obvious for those skilled in the art to modify process of Lin et al by using the antireflective coating as being claimed, per taught by Hussein et al to improve lithographic performance to the photoresist layer in subsequent step of exposing and developing for forming the photoresist mask.

5. Claim 5, as being best understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al [US 6,323,123] as applied to claim 4 above, and further in view of Ding et al [US 5,981,145].

Lin et al substantially discloses the claimed method including full-filling the aperture with a solvent based fill-in material to protect the insulation layer from poisoning in forming the dual damascene structure.

Lin et al is silent about full-filling the aperture with a water soluble fill-in material such as top antireflective coating.

However, Ding et al, the whole document with particularly col 2 lines 32-65 and col 7 lines 11-24, suggests using the antireflective coating with water-soluble fill-in material (strongly absorbing polymer that is soluble in water or water miscible organic solvent) would provide a better image transfer, (thinner coatings beneath the photoresist), a low toxicity hazard and easy handling or transportation in photolithographic patterning method.

Therefore, it would have been obvious for those skilled in the art to modify the process of Lin et al by using the water soluble fill-in material as being claimed, per taught by Ding et al, to full-fill the aperture for improving photolithographic pattern method with better image transfer and low toxicity hazard plus easy handling.

6. Claim 1, as being best understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al [US 6,569,760] in view of Lui [US 6,391,761].

Lin et al, figs 4-8 and col 1-4, discloses a method for lithographic patterning a via-first dual damascene process involving the use of a low-k dielectric material as an insulation layer on a wafer substrate during the fabrication of an integrated circuit, the method comprising the steps of:

covering the walls of an aperture (20, fig 5, col 3 lines 32-67) etched into an insulation layer (16) on a wafer substrate (10) with a fill-in material (22) for isolating a portion of the insulation layer in the aperture from a photoresist layer (26, fig 6) deposited thereafter, the fill-in material (inert polymer 22) being chemically inert to the low-K dielectric material;

depositing a photoresist layer (26, fig 6, col 4 lines 1-17) over the insulator layer and the fill-in material;

exposing and developing the photoresist layer for providing a photoresist mask pattern for subsequent etching of the insulation layer (fig 7, col 4 lines 18-22); and

removing the fill-in material from the aperture (fig 8).

Lin et al does not teach depositing anti-reflective material onto the insulation layer and in contact with the fill-in material for forming sacrificial layer.

Lui (figs 8-9, col 4 lines 42-67 and col 5 lines 1-10) discloses depositing the antireflective material (82, fig 8) onto the insulation layer (66/70/74) and in contact with the fill-in material (78) to improve resolution in photolithographic process in forming the via-first dual damascene structure.

Therefore, it would have been obvious for those skilled in the art to modify the process of Lin et al by depositing the antireflective material as being claimed, per taught by Lui, to improve the lithographic process in forming dual damascene structure with reason given above.

Response to Arguments

7. Applicant's arguments with respect to claims 1-2 and 4-5 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (703) 308-6172. The examiner can normally be reached on Monday-Thursday 8:00 AM - 7:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-3432 for regular communications and (703) 308-7725 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanhha Pham
June 17, 2003


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
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